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ABSTRACT

The use of instructional television (ITV) as part of an educational reform in grades 7, 8 and 9 El Salvador had a positive effect upon learning. This was achieved despite inequities in cognitive skills related to student background factors and inequities in resource distribution. In selected schools, 75% of the variance in cognitive skills in grade 7 could be predicted from background factors; this dropped to 66% after three years' participation in the reform program. In addition, students in reformed schools using ITV showed greater achievement than their counterparts in reformed schools without ITV. These results run counter to findings in the United States where background factors continue to dominate over innovations. There are at least three possible explanations. First, the El Salvador study used a longitudinal rather than a one-shot, cross-sectional approach. Second, ITV might have had a greater impact in El Salvador because it represented a larger and qualitatively more significant input to the system, relative to the previously existing levels of service. Finally, the ITV was of consistent quality, whereas innovations in the United States often vary in quality. (LB)

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TELEVISION, BACKGROUND CHARACTERISTICS AND LEARNING IN EL SALVADOR'S EDUCATIONAL REFORM

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TELEVISION, BACKGROUND CHARACTERISTICS AND LEARNING IN EL SALVADOR'S EDUCATIONAL REFORM

In the U.S., differences in school achievement between rich and poor, between suburban child and ghetto child, have not been significantly altered by increased investment in the schools of the disadvantaged. Rather, schooling has tended to widen gaps between rich and poor, or so the research seems to say (Coleman, 1966; Mosteller and Moynihan, 1972). While schooling obviously affects learning, such variations in schooling expenditures as exist do not. In contrast, in El Salvador, one innovation, an educational reform including instructional television, has had a significant incremental impact on learning.

In 1969, with some help from the U.S. Agency for International Development and other outside organizations, the El Salvador Ministry of Education launched a major educational reform. It included, for the seventh, eighth and ninth grades, curriculum reform, new student and teacher printed materials, bureaucratic reorganization, teacher retraining and television.

Each classroom received from three to five 20 minute weekly broadcasts in each of the five basic subjects. Student workbooks provided complementary text and exercises. Each teacher, many of whom were upgraded from primary school jobs, had been retrained for up to nine months in a subject specialty, pedagogical technique and utilization of television.

Simultaneously, the newly reformed Third Cycle (as grades

seven to nine are called in El Salvador) opened its doors to many more students. Free tuition, double sessions and a higher student/teacher ratio permitted a tripling of enrollment in the public schools.

While some critics have questioned the direction of the Reform, and others the adequacy of changes in some components, there can be little doubt that it represents a major restructuring.[1] However, if the U.S. research is taken as a guide, such changes should have had little effect. Predictors such as individual ability and personal, family and community background should have great importance, and variations in school quality relatively little.

As will be seen, background characteristics are important, predicting student test scores as they entered seventh and as they left ninth grade. However, none of them were as important as the presence or absence of a television in the classroom in predicting change between those two times. The apparent differences between the El Salvador results and the U.S. results demand more extended discussion, and they will have it, as soon as the results have been presented.

Description of the Study

Data were gathered on 29 classes of students who began seventh grade in 1970 and finished ninth in 1972. Those classes, rather than the individual students in them, serve as the sampling

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1 For a more extensive account of the Reform and its effects, see Hornik et al., 1973.

and analysis units for this paper.[2] The schools in which they studied were distributed across urban and rural areas, and were located in communities of differing wealth and development. Three types of variables were examined.

Student variables

During their three years in school students were administered General Ability and Reading tests[3] and achievement tests in three subjects: mathematics, social studies and science.[4] Scores on these five tests at the beginning of seventh, beginning of eighth and the end of ninth grades were separately averaged by classroom and combined into cognitive skill indices.[5] Thus each class was assigned three cognitive skills scores, one as it began Third Cycle, one for the beginning of eighth grade, and one as it finished Third Cycle.

Each class was also assigned the mean score of its members on personal and family background variables. These included wealth (based on family television ownership), father's education, mother's education, age, and proportion of students in the class who had

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2 Since ITV was distributed by classroom, its effect on within-class variance is likely to be very small and necessarily dependent on interaction with other variables. It is then reasonable, as well as required from a sampling theoretic perspective, to examine only between class variance in a study of ITV effect.

3 Level 4 of the Spanish language versions of the Interamerican Series, prepared by Guidance Testing Associates of Austin, Texas.

4 Tests prepared by the Educational Testing Service, Princeton, following the El Salvadoran curricula.

5 Index weights reflected each test's loading on the principal factor of a factor analysis.

repeated a grade. Data for those variables were collected from as many as five paper and pencil questionnaires administered during the three years of Third Cycle.

Community variables

When these students were in eighth grade, an investigation of the characteristics of their schools and communities was undertaken. Through examination of public records, observation and interview, a broad range of data was collected and then reduced to manageable scales. Three scales were constructed from the community data.

Educational availability was based on the opportunities in the community for continuing post-Third Cycle schooling. Graduates of 15 of the 29 schools could study either in Bachillerato (high school) or in a Carrera Corta (business course) without leaving their communities. Another eight schools were located within daily commuting distance of both types of post-Third Cycle education. However, graduates from six of the 29 schools who wished to continue their education needed to live away from home during the week.

Ease of access to a large city, the second community characteristics scale, was based on estimates of the time needed to travel by bus to the nearest large city and to the capital city. The final scale measured community resources. Five variables (presence of a bank, number of telephones per thousand population, percentage of paved streets, number of newspapers sold per thousand, and the presence of a factory in the community employing more than 50 persons) were

combined into a single index.[6]

School variables

Four indices were constructed to represent the range of information about schools. The first, school size, reflected the number of Third Cycle students in the school. Physical condition was the school director's general classification of his building's condition as bad, or good, or in between.

School directors also noted which of ten facilities their schools had: faculty library (10 schools had them), student library (9), a special room for a library (12), a science laboratory (5), inside plumbing (28), space for recess (20), an open field for physical education (12), an auditorium (8), a telephone (14), or a mimeograph machine (27). A school facilities Guttman scale was constructed from three of these, the presence of a faculty library, of a telephone and of a mimeograph machine.

Finally, an index reporting the adequacy of teaching materials was constructed from directors' responses to a general question on sufficiency of materials, and to two questions about specific types of materials which were lacking.

(Table 1 about here)

Interrelations among the Variables

Almost all of these variables are closely related (Table 1). The children from the highest socioeconomic strata attend the best

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6 Once again weights were assigned according to loadings on the principal factor of a factor analysis.

equipped schools in the most urban and wealthy communities, and they have the highest scores on the cognitive skills indices. The correlations were very high; some were over .70, and most were significant ($p<.05$), which, with only 29 classes in the sample, required a correlation greater than .31. They testify to how favored the advantaged children and schools were. All totalled, 75% of the variance (multiple r squared) in cognitive skills at the beginning of seventh grade could be predicted from these background and school variables.

What does this mean? Clearly, when El Salvadoran children arrive in seventh grade, what they know, and what skills they possess are profoundly affected by their backgrounds. If an observer knows class means of parent education and wealth, the average age of a child in the class, and perhaps something about the resources of the community, he can go a long way to predicting the level of cognitive skills likely to be found in that classroom.

In addition, as this table of correlations illustrates, not only do children from advantaged homes and communities bring better skills to Third Cycle, but they are favored in the distribution of school resources as well. Teaching materials are less likely to be adequate, the physical condition of the school is likely to be poorer, and the facilities probably fewer in the rural school drawing poorer students than in the city school with its higher SES students. Also while teacher quality was not evaluated as a part of this survey, other evidence indicated that this resource was distributed inequitably

as well. City schools were considered much more attractive places to work than were rural ones, and thus teachers with seniority and superior training and education gravitated to them. Into this context El Salvador introduced ITV, the first resource to be distributed universally and thus equally.

There is no doubt that the skills with which students left Third Cycle were closely related to those with which they entered. About 55% of the variance in skills at the end of ninth grade was predictable from scores at the beginning of seventh. If one were to use all of the background information, with or without the cognitive index score from the beginning of seventh, to predict cognitive index scores at the end of ninth, it would account for 66% of the variance.

However, recall that those background and school characteristics predicted some 75% of the variance in the seventh grade cognitive score. The drop (from 75 to 66) in predictive power means that not only was there an important change in the cognitive index over the three years, but it also indicates that the change was unrelated, or was negatively related, overall, to those background and school characteristics. Certainly the influence of background factors on skills was not eliminated; however, three years of schooling did result in some reduction of their importance. In contrast, U.S. research has suggested that background factors increase their absolute importance with additional years of schooling (Mosteller and Moynihan, p.14).

The Influence of ITV

Of the 29 classrooms, three were located in the capital city.

All had ITV, and if kept in analyses of ITV's effects, they surely would have biased the results. Those classes were eliminated, leaving 26 classes, 15 of which used ITV, 11 of which did not. All of these classes studied with the non-ITV components of the Reform (new curricula, student and teacher printed materials, retrained teachers, etc.). Results reported here thus reflect comparisons between classes with the Reform and ITV and classes with the Reform but without ITV.

ITV was not assigned randomly within the sample; the political and administrative constraints of the school system did not permit that. However, the effort at matching subsamples proved quite successful.[7]

The 26 classes were ranked according to their scores on the cognitive index at the beginning of seventh grade and again on their scores at the end of ninth. The highest mean score among the classes received rank 1, the second highest 2, and so on down the line to 26.

At the beginning of seventh grade, the ITV and non-ITV subsamples achieved virtually identical mean ranks of 13.5. Thus the assignment of ITV to a class was apparently unrelated to cognitive skills. By the end of the three years of Third Cycle the situation had completely changed. The ITV mean rank at the end of ninth grade had risen to 10.1, while the non-ITV mean had fallen to 18.2. The

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7 There was some slight bias towards schools with ITV being in better physical condition than schools without, since one of the minimum criteria for having a TV receiver installed in the first years of the Reform was a secure and lockable building. It is not likely that this bias explains the apparent influence of ITV on learning. Physical condition correlated with learning, but less so than did presence of ITV. In addition, the fact that other school quality variables were unrelated to learning would indicate that the physical condition/learning relation was a spurious one resulting from their common relation to presence of ITV.

ITV classes had far outperformed the non-ITV classes.

It should be recalled that given 15 ITV classrooms out of a total of 26 classrooms, the best mean rank that the ITV classes could have achieved was 8.0, and that only if they had occupied ranks 1 to 15. Conversely, if the 11 non-ITV classes had occupied ranks 16-26, they would have reached their minimum mean rank of 21.0. Given these maximum and minimum levels, the amount of change that did occur was quite large and statistically significant (Table 2).

(Table 2 about here)

From another perspective, out of the 15 ITV classes, 11 (or 73%) moved up in rank between the beginning and end of Third Cycle. Of the 11 non-ITV classes, only two (or 18%) moved up in rank. In fact there was no other community, school or background variable which had as strong an effect on change in the cognitive index as did membership/non-membership in an ITV class.

Table 3 reports Pearson correlations between each of the community, school and background variables, membership in an ITV classroom, on the one hand, and cognitive index scores (beginning of seventh, end of ninth, change between those times) on the other. The correlations of the predictor variables with the cognitive indices differ from those reported in Table 1 because the three capital city ITV classes were eliminated.

(Table 3 about here)

At the beginning of seventh grade membership in an ITV class was a non-significant predictor of cognitive skills. Of the other ten predictor variables, nine had larger correlations with the index. In contrast, at the end of ninth grade only two other predictors (wealth

and age) had larger bivariate correlations with the cognitive index. None of the other variables was a better predictor of change on the index over the three grades. Only one other variable, father's education, was even a significant ($p<.05$) predictor of cognitive skills change, and it was a negative predictor.

Discussion

The results seem unequivocal. The investment in ITV significantly affected learning and reduced the quite awesome influence on cognitive skills of background and community factors and their correlate, the skills students bring to their seventh grade classroom. Why did this study produce such strikingly different results from U.S. investigations? There are several considerations which may explain the differences.

It is clear that there are important methodological differences between much of the U.S. literature and the El Salvador studies. The former are by and large surveys, one shot cross-sectional investigations of a large number of schools. The latter was a quasi-experimental three year panel study of a small sample of schools. However, even if the El Salvador studies had been limited to a survey of the 16 classes as they finished ninth grade, the conclusions would have been the same, essentially those which can be derived from the second column of Table 3. The decline in importance of background factors might have been missed, and the inferences about ITV's influence on change in cognitive skills would have depended on assumptions rather than evidence that the

original distribution of cognitive skills was unrelated to assignment to an ITV class. Nonetheless the contradiction between the U.S. and Salvadoran results would have remained.

In fact, the reasons for the differences are likely substantive rather than methodological in origin. One involves the difference in respective starting points of the two school systems. There can be little doubt that the minimum levels of teacher quality (at least as measured by education, training, and knowledge of pedagogical technique) and of school facilities in the U.S. were superior to their maximum levels in El Salvador. In El Salvador per capita student expenditure was in the range of $75-100; U.S. expenditure per student is more than 10 times that. Even excluding the portion of the large teacher salary differential unrelated to qualification, the gap between the level of expenditure of the two systems is cavernous.

Given the U.S. customary level of expenditure, new investments, or variations in investment between central city and suburb of the same state, may be of minor importance. As a percentage of total expenditure they may be small. Or there may be a plateau effect on investment. The marginal return on additional investment given a high pre-existing level of expenditure may be small.

In El Salvador, in contrast, ITV was a significant investment. It may account for 25% of the instruction cost of each student.[8] Of

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8 See Hornik et al., 1973, pp.198-242 for details. This was largely a substitute for, rather than an add-on to, teacher expenditures, as a result of manipulations of student hours, teacher hours and salaries, and class size.

more importance, qualitatively it loomed much larger in the poorly equipped and less well staffed El Salvadoran classroom, than a similar innovation would have in the U.S. One explanation then for the difference between U.S. and El Salvadoran results is qualitative import of each of the innovations relative to the starting points of their respective school systems.

A second reason for the contrasting findings may reflect differences in consistency of the quality of innovations investigated. A particularly instructive comparison can be made with the Westinghouse (1969) evaluation of the head start pre-school programs. Overall, it was suggested, such programs had not achieved their ends. The inference to be drawn was that investment in this area did now show a sufficient return and should be reduced or dropped. However, two reviewers (Smith and Bissell, 1970) noted that among the programs studied there were some notable successes. They implied that the proper inference was not that the funding should end, but rather that an effort be made to uncover the reasons for success and failure, so that the successful projects might be copied.

Similarly, the Coleman survey lumped together a wide variety of quantitatively equal but qualitatively different educational expenditures and found them on the average ineffective. The El Salvador evaluation examined one type of investment, one of significant quality, and found it effective. It suggests that while indiscriminate spending will not achieve results, investment in some innovations may.

As a final note, the substance of the findings should be

carefully restated. Instructional television, despite existing inequities in cognitive skills related to background and correlated inequities in school resource distribution, affected learning in an important way. To avoid misinterpretation, it should be stated clearly that this does not imply that ITV, applied throughout a school system has the potential for redressing those inequities. In this particular research context, when some schools had ITV and some did not, there was some reduction in the importance of background influences. However, this, as far as the present evidence is concerned, was a function of differential application of ITV; classes of poorer children with ITV improved more than some classes of wealthier children without it. If ITV had been applied universally (as it is at present) there should be no expectation that poorer children will benefit from it more or less than wealthier ones.[9]

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9 In Hornik et al., 1973, pp.40-46, however, evidence is presented which suggests that among non-ITV classes the general ability gap between urban and rural students was opening during the three years of Third Cycle, while among ITV rural and urban students the gap neither opened nor closed. At the same time, in both ITV and non-ITV classrooms, gaps between male and female students, and between younger and older students in a classroom (age reflecting the tendency to enter school late and/or miss or repeat a year) opened during the Third Cycle years.

Table 1

CORRELATIONS AMONG COGNITIVE SKILLS
COMMUNITY, SCHOOL AND PERSONAL CHARACTERISTICS
(N = 29 CLASSROOMS)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Personal & Family	1. Father's Education														
	2. Mother's Education	.822													
	3. Age	-.728	-.726												
	4. % Repeaters	-.633	-.644	.613											
	5. Wealth	.715	.729	-.792	-.363										
School Variables	6. School Size	.644	.488	-.724	-.538	.629									
	7. Physical Condition	.311	.364	-.584	-.257	.480	.475								
	8. Teaching Materials	.360	.367	-.309	-.447	.267	.183	.427							
	9. School Facilities	.393	.300	-.301	-.531	.168	.586	.254	.549						
Community Variables	10. Educational Availability	.609	.499	-.633	-.385	.520	.708	.327	.111	.330					
	11. Access to the City	.443	.392	-.333	-.340	.530	.351	.474	.499	.220	.242				
	12. Community Resources	.773	.603	-.704	-.450	.739	.792	.407	.347	.355	.844	.530			
	13. Cognitive Skills (7th Beg.)	.771	.694	-.580	-.441	.711	.434	.403	.262	.163	.397	.502	.577		
	14. Cognitive Skills (8th Beg.)	.666	.584	-.626	-.418	.625	.505	.632	.323	.296	.469	.592	.587	.741	
	15. Cognitive Skills (9th End)	.563	.624	-.683	-.436	.649	.454	.624	.336	.215	.304	.479	.477	.733	.803

Correlations larger than .31 were significant at $p<.05$

Table 2

COGNITIVE SKILLS AND METHOD OF INSTRUCTION
COHORT B, BY CLASSROOM
(N = 26)

Cognitive Measures	Mean Ranks ITV	Mean Ranks No ITV
Cognitive Index (7th Beginning)	13.53	13.45
Cognitive Index (9th End)	10.07*	18.18*

* Difference sig. at ($p<.02$) on Mann Whitney U Test

Table 3

CORRELATIONS: PREDICTOR VARIABLES, USE OF INSTRUCTIONAL TELEVISION, AND COGNITIVE INDEX SCORES (N = 26 SCHOOLS OUTSIDE OF CAPITAL CITY)

	Cognitive Index Beginning 7th	Cognitive Index End 9th	Change on Cognitive Index 7th to 9th Grades
Father's Education	.75	.41	-.41
Wealth	.64	.57	-.13
Age	-.47	-.63	-.12
Repeated Grade (0 = No, 1 = Yes)	-.32	-.31	.04
Community Resources	.49	.36	-.18
School Size	.34	.38	.01
Adequacy of Teaching Materials	.03	.09	.06
Educational Opportunity	.32	.20	-.15
Ease of Access to City	.30	.24	-.09
Physical Condition of School	.14	.43	.28
ITV (0 = No, 1 = Yes)	.07	.52	.45

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